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SUPPLEMENT ARTICLE

Occurrence of common dolphins (*Delphinus delphis*) in the Gulf of Trieste and the northern Adriatic Sea

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Abstract

1. The Mediterranean common dolphin (*Delphinus delphis*), considered to have been very *common* in the past, had undergone a dramatic decline across most of the basin by the end of 1970s. In the northern Adriatic Sea, one of the regions with most available historical information, the common dolphin is thought to have been the most common and abundant cetacean throughout most of the 20th century. However, by the end of 1970s, it had virtually disappeared from the region and is now considered generally absent from the entire Adriatic Sea.
2. This contribution summarizes the occurrence of common dolphins in the Gulf of Trieste and provides a brief review of published records in other parts of the Adriatic Sea.
3. Systematic boat surveys in the wider area of the Gulf of Trieste between 2002 and 2019 confirmed that the common bottlenose dolphin (*Tursiops truncatus*) is the only regularly occurring cetacean species in this area. Despite this, several records of common dolphins were documented in the Gulf of Trieste between 2009 and 2012, through sightings of live animals or recovery of dead stranded animals.
4. Dorsal fin markings allowed the photo-identification of some of these, suggesting that at least four different live individuals (three adults and one calf) occurred here in recent times. Most cases involved single adult individuals, but one included a mother-calf pair that was temporarily resident in a port for several months, a behaviour atypical for this species. Photo-identification showed that the presumed mother had previously been sighted in the Ionian Sea in Greece, over 1,000 km from the Gulf of Trieste, making this the longest documented movement for this species worldwide.
5. At present, the common dolphin continues to be rare in the region.

KEYWORDS

Adriatic Sea, common dolphin, *Delphinus delphis*, distribution, Gulf of Trieste, Mediterranean Sea, photo-identification

1 | INTRODUCTION

The common dolphin[1] (*Delphinus delphis*) in the Mediterranean Sea is a somewhat enigmatic species. Considered to have been very *common* in the past, it had undergone a dramatic decline across most of the basin by the end of 1970s (Bearzi et al., 2003). Today, the only place where the species can still predictably be found in large numbers is the Alboran Sea (Bearzi et al., 2003; Cañadas & Hammond, 2008; Cañadas & Vázquez, 2017). The exact reasons and mechanisms of this decline are still largely unknown or not well understood, but a suite of likely causes has been identified, including intentional culling, incidental mortality in fishing gear, reduced prey availability, and habitat degradation (Bearzi, Agazzi, et al., 2008; Bearzi et al., 2003; Bearzi, Holcer, & Notarbartolo di Sciara, 2004; Piroddi, Bearzi, Gonzalvo, & Christensen, 2011). The International Union for Conservation of Nature has listed the Mediterranean subpopulation of common dolphins as Endangered (Bearzi, 2012).

In the northern Adriatic Sea, one of the basins with most available information, the common dolphin is thought to have been the most common and abundant cetacean throughout most of the 20th century (Bearzi et al., 2004). However, by the end of 1970s, it had virtually disappeared, much like in many other Mediterranean areas. This decline was probably primarily driven by systematic culling campaigns, in conjunction with habitat degradation (Bearzi et al., 2004).

Fifteen years after the last comprehensive review by Bearzi et al. (2004), and in light of several recent new records, it was felt appropriate to undertake a review of recent records of common dolphins in the region. This paper reviews the past and present occurrence of the common dolphin in the Gulf of Trieste (northern Adriatic Sea), based on published and unpublished accounts as well as original new data, and published records available for the Adriatic Sea. It also provides the first confirmed records of this species for Slovenian waters, and thus adds to the list of cetacean fauna recorded in Slovenia.

2 | METHODS

Available information was compiled from various sources, including the scientific literature ('grey' literature was considered only if it provided relevant information that could not be obtained otherwise), public and opportunistic reports validated by photographs or video, and unpublished field records from recent dedicated surveys, opportunistic observations or stranding records.

[1]Two species of common dolphins were previously recognized: the short-beaked common dolphin (*Delphinus delphis*) and the long-beaked common dolphin (*Delphinus capensis*). However, in light of recent evidence, the Committee on Taxonomy of the Society for Marine Mammalogy (https://marinemammalscience.org/species-information/list-marine-mammal-species-subspecies/) no longer recognizes the long-beaked common dolphin as a distinct species. Therefore, the common English name for the only recognized species, *Delphinus delphis*, became 'common dolphin' and is used here.

3 | RESULTS

3.1 | Historical records in the Gulf of Trieste

It appears that the last time common dolphins were reported from the Gulf of Trieste, prior to their large scale disappearance, was in the 1940s (Bearzi et al., 2004; Pilleri & Gihr, 1977). In particular, Pilleri and Gihr (1977) noted the following:

> "According to reports from the Trieste sailing community, this species has become increasingly rare in the Northern Adriatic during the past 40 years. Before that large numbers of *Delphinus delphis* were regularly to be seen in the Gulf of Trieste, only about 100 metres from the shore, an event which is extremely rare today. We do not know what factors are responsible for the decline in numbers."

Since then, there have been no records of this species from the Gulf of Trieste, nor from nearby areas, until the records presented here. In their review of cetacean records in the northern Adriatic, Kryštufek and Lipej (1993) refer to a specimen from Zaule (Bay of Muggia, Trieste, Italy), once held at the Trieste Museum of Natural History as reported by Brusina (1888), but report no other records. Francese, Zucca, Picciulin, Zuppa, and Spoto (1999) provided a list of opportunistic cetacean records, largely collected through stranding and sighting reports by the public, along the Italian coast of the Gulf of Trieste and the Grado-Marano lagoon between 1990 and 1998. Not a single case of the common dolphin was recorded in that period.

Dedicated systematic boat and land-based surveys in the wider area of the Gulf of Trieste between 2002 and 2019 (Genov, Kotnjek, Lesjak, Hace, & Fortuna, 2008; Genov, Centrih, Kotnjek, & Hace, 2019; Genov, Jepson, et al., 2019) confirmed that the common bottlenose dolphin (*Tursiops truncatus*, here after "bottlenose dolphin") is the only regularly occurring cetacean in the region.

3.2 | Records in Slovenia

Based on the Zaule specimen referred to by Kryštufek and Lipej (1993), and given that the distance between Zaule and the Slovenian–Italian border is only a few kilometres, the common dolphin was included in the list of mammals of Slovenia, on the premise that it must have crossed Slovenian waters at some point (Kryštufek, 1991). Furthermore, the species is listed in the Slovenian Red List of Mammals as Endangered (Official Gazette of the Republic of Slovenia No 82/02). However, the common dolphin has never actually been documented in Slovenian waters at any point in history (Genov et al., 2008; Kryštufek & Lipej, 1993), prior to records reported here.

3.3 | Recent records in the Gulf of Trieste

There are four cases of common dolphin occurrence in the Gulf of Trieste in recent times (Figure 1). For the purposes of this paper, individual cases presented here may represent multiple sightings of the same individuals over variable periods. Due to the nature of these sightings and the available photo-identification data, repeated sightings of the same identified individual are treated as a single case, rather than considering each sighting as independent. One case refers to a published record, while the remaining three records are new.

3.3.1 | Case 1

On 23 February 2009, an adult common dolphin was observed and photographed off Izola, Slovenia. The available photographic evidence (Figure 2) enables the species identification, but also allows the approximate location of the sighting to be inferred and corroborated. This is the first actual record of common dolphins ever reliably recorded in Slovenian waters or the Gulf of Trieste. Even though photographic quality is not sufficient to allow photo-identification, the coloration patterns (including on the rostrum, dorsal fin and lateral side of the body) allowed the photographed individual to be distinguished from other individuals described below.

Interestingly, this sighting occurred while a single humpback whale (*Megaptera novaeangliae*) – a species not present regularly in the Adriatic or Mediterranean Seas – was being monitored off the coast of Piran (about 8 km away) at the same time (Genov, Kotnjek, & Lipej, 2009). It was suspected that the presence of the humpback whale may have been related to the unusual occurrence of a large number of gilt sardines/round sardinella (*Sardinella aurita*) during that time (Genov et al., 2009). Given that *Sardinella aurita* is a common prey species of common dolphins in the Mediterranean Sea (Bearzi et al., 2003; Cañadas & Hammond, 2008; Milani et al., 2018), the increased influx of the species may have contributed to the presence of the common dolphin as well.

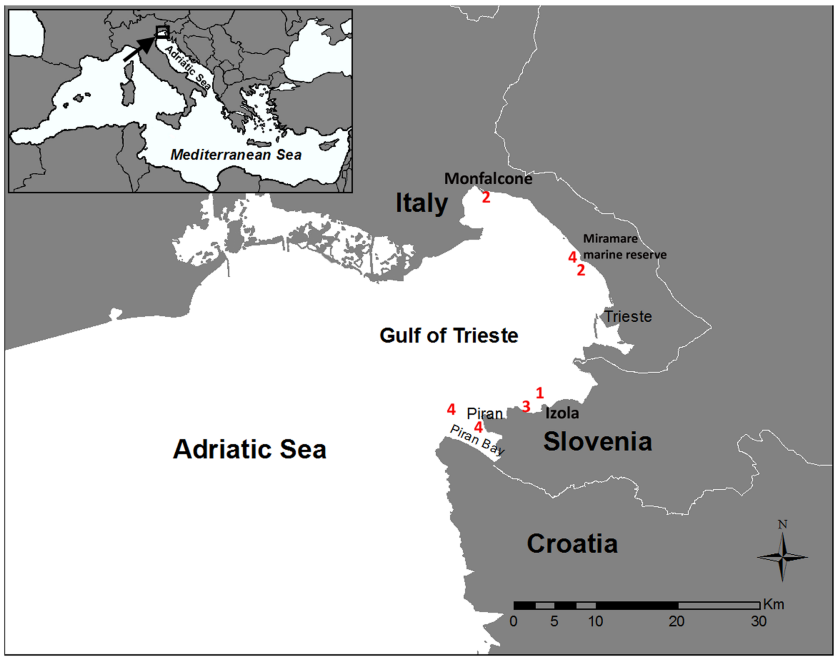

FIGURE 1 Records of common dolphins (*Delphinus delphis*) in the Gulf of Trieste, with some locations referred to in the text. Numbers represent different cases (see main text for details), with the same number representing different locations of multiple sightings of the same individuals. The upper left inset shows the location of the study area within the Adriatic Sea

FIGURE 2 Case 1. Common dolphin (*Delphinus delphis*) photographed off Izola, Slovenia, on 23 February 2009. Photos: Robert Novak, Nemo Divers

FIGURE 3 Case 2. Features used to confirm the long-distance match of a common dolphin (*Delphinus delphis*) reported in Genov et al. (2012). Left: dorsal fin and rostrum of the individual photographed in the Inner Ionian Archipelago, Greece, in 2008 (photos by Annalise Petroselli, Tethys Research Institute). Right: dorsal fin and rostrum of the individual photographed in the Gulf of Trieste, Italy, in 2010 and 2011 (photos by Tilen Genov, Morigenos – Slovenian Marine Mammal Society)

FIGURE 4 The skull of the immature common dolphin (*Delphinus delphis*) found stranded near Izola, Slovenia. From top to bottom: the dorsal, lateral, and ventral views, respectively. The ventral view shows the palatal grooves, diagnostic for the species. Photos: Tilen Genov

3.3.2 | Case 2

The second case pertains to repeated observations of an adult (presumably female) accompanied by a calf, observed in the port of Monfalcone, Italy, between 2010 and 2011. This case was described in detail by Genov, Bearzi, Bonizzoni, and Tempesta (2012). In summary, in June 2010, the pair was observed in the port of Monfalcone, Gulf of Trieste (Figure 1). The pair was repeatedly sighted there between June 2010 and January 2011, in an area of 1.2 km^2. The adult appeared in good physical condition, while the calf initially appeared in good condition but started showing signs of emaciation by January 2011. In February 2011, the calf disappeared. After this, the adult was occasionally observed both inside the port, as well as in various locations outside of it, including near the Miramare marine reserve (Figure 1), until August 2011. This individual was previously observed in the Inner Ionian Sea Archipelago, Greece, in August 2008, more than 1,000 km away, making this the longest documented movement for any individual of this species, worldwide (Genov et al., 2012). Photographs of dorsal fin markings, as well as photographs of the rostrum, showing a small injury, confirm the match beyond any doubt (Figure 3).

3.3.3 | Case 3

On 9 April 2011, a highly decomposed carcass of a juvenile delphinid was recovered near Izola, Slovenia. A full necropsy was subsequently carried out on the carcass. The advanced decomposition of the carcass prevented initial individual or species identification. Nevertheless, the osteological material enabled us to identify the specimen as a common dolphin (Figure 4). *Delphinus* spp. skulls are markedly different from those of all other delphinids, in that they feature a combination of a long narrow rostrum and deep palatal grooves (Perrin, 2009). In this individual, the palatal grooves were deep, while the palatal ridge was trapezoid in shape, moderately broad and long, encompassing over 50% of rostrum length. The neurocranium was longer than it was broad. These and other characteristics are diagnostic of *Delphinus* spp.

As carcass decomposition prevented individual photo-identification, it is impossible to determine whether this individual is the calf of the presumed female reported above (case 2, Genov et al., 2012). Nevertheless, given the timing and location of the stranding, and the size of the animal, it appears plausible that this is the same calf initially observed in the port of Monfalcone.

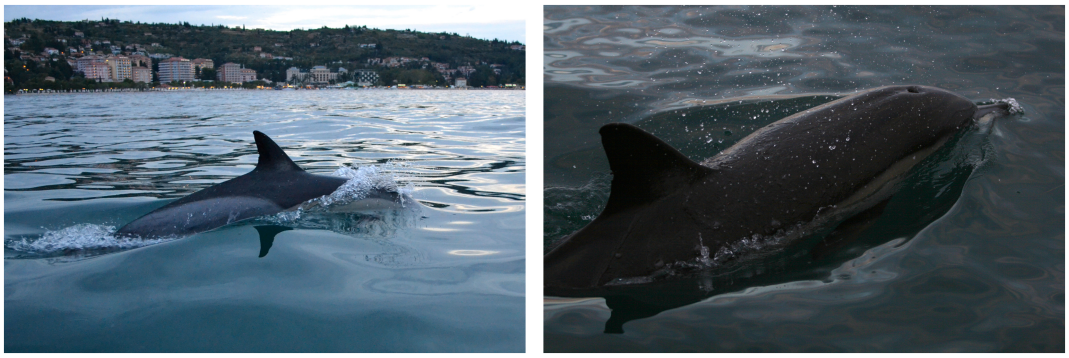

FIGURE 5 Case 4. Common dolphin (*Delphinus delphis*) photographed off Piran and Portorož, Slovenia, on 30 August 2012. Photos: Marina Koren (left) and Polona Kotnjek (right), Morigenos

3.3.4 | Case 4

On 30 August 2012, during a regular survey for bottlenose dolphins (Genov et al., 2008), a single adult common dolphin was recorded a few hundred metres from the coast of Piran, Slovenia, and subsequently followed alongshore off the towns of Piran and Portorož (Figure 5) until dark. The animal appeared in good condition, with no evidence of malnutrition or abnormal behaviour. Photo-identification showed that this was a new individual from those previously sighted off Izola (case 1) or in the port of Monfalcone (case 2). However, opportunistic reports and photographs provided by people active at sea showed that this same individual was previously sighted near Miramare marine reserve, Italy (Figure 1) on 17 July and 27 July 2012, and subsequently sighted again off Piran on 11 September 2012 (Figure 1), after which it was not sighted again. A comparison with the catalogue of common dolphins from the Inner Ionian Sea Archipelago (Bearzi, Agazzi, et al., 2008; Bearzi et al., 2005) did not result in any matches (J. Gonzalvo, Ionian Dolphin Project, personal communication).

4 | DISCUSSION

The new records of common dolphins in the Adriatic Sea presented here include the first confirmed and conclusive records for this species for Slovenia. Regular surveys of the entire Gulf of Trieste have been carried out since 2002, covering the entire Gulf and its surrounding waters (Genov et al., 2008; Genov, Jepson, et al., 2019). Between 2002 and 2012 these were mainly restricted to July–September, with occasional surveys in other months, while since 2013 monitoring has been carried out year-round. As such, the area has received a substantial amount of spatial and temporal coverage over the past 18 years. Given this, it is probably reasonable to assume that any regular or substantial presence of common dolphins in the area would not go unnoticed, and thus it is concluded that common dolphins continue to be rare in the area.

This species was once apparently common in the Gulf of Trieste and the northern Adriatic Sea (Bearzi et al., 2004; Pilleri & Gihr, 1977), but its occurrence in the region has been extremely rare in the past 30 years. During this time, only a handful of records are known from the entire northern Adriatic Sea. Bearzi and Notarbartolo di Sciara (1995) reported three records of common dolphins from the Kvarnerić archipelago in Croatia: August 1991 (four individuals), August 1994 (one individual, the same as one observed in the group of four in 1991, this time seen in a group of bottlenose dolphins) and July 1995 (one individual, the same one observed in 1991 and 1994, in the company of the same bottlenose dolphin it was observed with in 1994). Bortolotto (1995) reported a sighting of a single individual 27 km south of Caorle, Italy, in November 1995. Two female individuals were reported stranded on the Italian coast of the northern Adriatic Sea in 2000 (Monitoring of Cetacean Strandings on Italian Coasts database, http://mammiferimarini.unipv.it). In 2004, an adult male common dolphin was found dead on the island of Cres, Croatia (Lazar et al., 2012). In 2008, an adult common dolphin was opportunistically photographed on two occasions, together with a striped dolphin (*Stenella coeruleoalba*) in the Vinodol channel, Croatia (Rako, Holcer, & Fortuna, 2009).

The majority of cetacean surveys and investigations of stranded cetaceans carried out in the Adriatic Sea since the 1990s have resulted in no records of common dolphins (Bearzi, Azzellino, Politi, Costa, & Bastianini, 2008; Bearzi et al., 2009; D'Astore, Bearzi, & Bonizzoni, 2008; Notarbartolo di Sciara et al., 1993), with the exception of two sightings in the southern Adriatic Sea (Boisseau et al., 2010). Two aerial surveys carried out in 2010 and 2013, covering the entire Adriatic Sea, yielded no confirmed sightings of common dolphins (Fortuna, Holcer, Filidei, Donovan, & Tunesi, 2011; Holcer & Fortuna, 2015). A total of five records of stranded individuals exist for the Italian coast of the central Adriatic Sea between 1991 and 1999 (http://mammiferimarini.unipv.it). The OBIS-SEAMAP database (http://seamap.env.duke.edu/) contains nine additional records from a ferry in the southern Adriatic Sea between 1990 and 1997 (by a single data provider), but since these could not be verified due to failed attempts to contact the data provider, their reliability remains uncertain.

Despite the species' continued rarity in the region, it is interesting to note that the records presented here are relatively numerous for the small area and the relatively short period considered. This contribution presents four cases of at least four different individuals (three adults and one calf) between 2009 and 2012, which is close to the number of previous published records for the entire Adriatic Sea since

the 1990s. Whether this is due to the Gulf of Trieste (a) somehow being ecologically more interesting or attractive for the species, (b) being an ecological *cul-de-sac* for lone or compromised individuals, or (c) simply being an area with more human presence and research activity leading to species presence being recorded, remains unknown. However, as pointed out earlier, given the amount of survey effort in this area, the last option seems an unlikely explanation. With the exception of the calf observed in association with the adult in Monfalcone port (case 2, Genov et al., 2012) and the stranded calf found near Izola (case 3), which possibly represent the same individual, all other individuals appeared in good physical condition. In fact, they all even displayed aerial behaviour such as jumps and leaps (Figure 2, Genov et al., 2012). Interestingly, the individuals 2 and 4 both repeatedly displayed apparently playful interactions with barrel jellyfish (*Rhizostoma pulmo*). Individuals 2 and 4 were also resident for a relatively prolonged period in the area, since individual 2 stayed there for at least 15 months and individual 4 stayed there for at least 56 days. Even though this does not dismiss the possibility of the *cul-de-sac* effect, the apparent good physical condition in conjunction with prolonged residence suggests this explanation is not very likely either. As stated earlier, the occurrence of case 1 may have been related to the unusual presence of *Sardinella aurita*, but this would not explain the presence of other individuals in subsequent years.

Future records will hopefully provide further insights into the occurrence of common dolphins in the region, while this contribution can serve as a baseline and encourage potential new cases to be reported. It is tempting to consider the possibility of the species potentially making a comeback into the region. This would certainly be an exciting prospect, but there is currently no evidence of any recovery or increase in common dolphin abundance anywhere in the Mediterranean Sea.

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